THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

VOLUME XVIII.—No. 7.
WHOLE No. 318.

NEW YORK, WEDNESDAY, APRIL 2, 1873.

$3 PER ANNUM
IN ADVANCE.

Water Meters.

By JAMES A. WHITNEY, M. E.

Few topics of a mechanical character have been more bewritten with diminutive results than that indicated by the caption of this article. Every large city in the civilized world has been compelled to provide works for the supply of water to its denizens. Sometimes, as in New York, this has been done by the municipality; sometimes, as in London, by private companies. In either case the difficulty of setting a check on consumption has acted as a premium on waste. Twenty years ago the report of the Croton Board (New York city) called attention to the fact that "a very great proportion of the water placed at the disposal of the consumer is used for no valuable or practical purpose." During the intervening period scores of inventions designed to measure the flow of water from the branch pipes of the mains and from the faucets of buildings have been devised. Of these, perhaps one in ten possessed merit enough to entitle it to thorough trial, but not one in fifty has secured any permanent foothold, as far as extended use or general introduction is concerned. But even the poorest of them would have saved at least a portion of the 60 per cent. of the water supply which is calculated to be the proportion of annual loss. Even this, high as it is, is probably below the actual ratio. An estimate made some ten years since, and based upon returns from six of the principal cities in the United States, showed the average actual cost to the city to be eight mills per hundred gallons, while the average charges to consumers were 32 mills to the hundred gallons—the difference indicating the presumed difference between the quantity used and that supplied. But despite this high ratio of water rates, the water boards of most cities have, at one time or another, suggested the use of meters—a remark especially applicable to Chicago, where the expense of water raising and distribution resolves itself into a question of coal and steam engine repairs, and is, therefore, pretty accurately known. It may be remarked, in passing, that a surplus of water has been known to produce some notable and unlooked for results, as, for instance, in Glasgow, where the opening of the Loch Katrine water works is said to have reduced the consumption of soap to the extent of a quarter million dollars of our money the first year.

I am not now speaking in favor of any particular meter—not even in favor of any particular system. After having examined many models, I am decidedly of the opinion that not one meets all the requirements of a perfect meter, and I doubt very much whether any one can be suited to all conditions of water measurement. The apparatus that will measure accurately under a uniform head will fall under a variable pressure.

The small device fitted for a dwelling will scarcely, in its construction, suit the requirement of the three, four, or six inch pipe leading to a dye works, paper factory, or like industrial establishment. Considered merely with reference to their uses, water-meters, if ever permanently and widely introduced, will probably be classified for streams of, say, one half inch diameter, for ordinary faucets and the like; those for pipes ranging from one to two inches diameter, and used in the supply of tenement houses and hotels, where measurement for each particular outlet would be impossible, and for steam boilers requiring more than the smaller pipe could supply; and those of the greater size required by manufactories, etc. Mechanically considered, the most available varieties of meters are the dumping meter, in which a vessel of known capacity is automatically filled and tilted to pour out its contents thus measured; the rotary meter, in which vanes or wings, either spiral or radial, moving on a central axis, are acted upon by the flow of water, a certain amount of flow through a space of known diameter producing one revolution of the device; and the piston meter, in which a piston is moved to and fro in a cylinder, by water admitted alternately at its oppcsite ends, in a manner similar to the action of steam in an ordinary engine, the capacity of the cylinder, *minus* the space occupied by the piston, being the measure of the water admitted and expelled at each stroke of the latter. The moving parts in each one are connected with simple clock work mechanism moving under fingers arranged in due relation to dial plates, to record, as the case may be, the tiltings of the dumping vessels, the revolutions of the vanes or stroke of the piston.

In the adaptation of meters to the various conditions of water measuring, I am disposed to think that a somewhat bulky, but efficient, device for faucet use could be constituted by combining the ordinary spring or closing faucet with a dumping device, the former preventing neglect to shut off the flow when not required; the latter measuring the quantity actually used. This apparatus would be independent of the head. For the second class of uses, the rotary meter, although not the most accurate, works with less friction than the piston meter, and would, all things considered, probably be preferable. The range of improvement, real or alleged, is greater in this than in any other kind of meters, for we have only to reverse the action of almost and rotary pump, and fit it with a registering mechanism, to convert it into a very tolerable rotatory water measurer. So also with a rotary steam engine; fit it with an index device, and turn a flow of water instead of steam through it, and the transformation is complete. Rotatory water meters possess one advantage over others, in the facility with which their most important parts can be shaped, by turning in a lathe either of special or ordinary construction.

For the larger pipes, two to six inches in diameter, I should recommend a piston meter, especially if the flow have any material degree of pressure; for when of large size the friction in proportion to the volume of water passed, is much diminished. On these there is some chance of profitably employing a modification to which, thus far, I have not referred. This is the differential meter so called, in which a small but ascertained proportion of the flow is diverted to a measuring and recording device, to be taken as an indication from which the entire volume passed may be calculated.

These remarks have been called forth as *apropos* at the present time, when even the New York city charter is sought to be made the means of securing the adoption of a special and particular meter, a matter which, it may be readily inferred from the foregoing, seems to me impolitic and contrary to the best interests of the public, and to the great number of inventors who have devised methods more or less complete for water measurement. No meter is exact in its work, but for all practical purposes a close approximation to accuracy is sufficient. This is given by more than 1 or 2 of the meters now before the public, and it would be well if a certain standard of efficiency were established, and each water consumer left to select a meter for himself, provided it gave a reasonably accurate return of the volume passed through it.—*Iron Age.*

Blackwell's Island Water Supply.

On Friday, March 14, the engineers of the Department of Public Works succeeded in solving a problem which has apparently baffled them for years, and established what promises to be a means of permanent supply of water for Blackwell's Island. As long ago as 1850 one or more mains were laid for conveying Croton to the island, but being of small diameter, generally six inches, they were subject to the action of the frost, and also liable to be detached and carried away by vessels catching their anchors under them. In this way the sections were repeatedly detached and had to be renewed sometimes once or twice in a single season. During the winter the temperature of the water in the river very often sank to 30° Fahr., and the motion of the current also abstracted the heat from the pipe, which was of iron, to such an extent that if the water inside was not kept running it almost immediately froze, which it repeatedly did. To obviate this at one time gutta percha pipes were substituted, but these, in addition to being more easily broken by the anchors of vessels, were continually being worn through by the current rubbing them against the rocky bottom of the river. So repeatedly were the pipes, whether of iron or gutta percha, rendered useless in some way or other, that, although there were two mains, one at Sixty-first street and another at Seventy-ninth, at one time there was one at Seven-

tieth street, the island was continually left dependent upon the two weeks' supply in its reservoir, and sometimes water had to be carried over in boats.

The main laid on Friday consisted of an iron pipe six inches in diameter, encased in a box formed of heavy timber, twenty-two inches square. The planks were firmly welded and riveted together, the intervening space being filled in with closely packed cement, and the whole forming a single continuous mass nearly 1,360 feet in length. When lying along Sixty-second street, in process of formation, it extended nearly to Second avenue. The total weight was about 200 tons. The river at this point is 1,440 feet wide and nearly 100 feet deep, while the current moves at least six miles an hour, so that the safe landing of this enormous mass was quite a triumph of engineering skill. The means used were a dredge-boat of 100 horse power, worked along a wire cable one inch and a half in diameter, and two powerful tug-boats. Under the main, at intervals of every seventy-five feet, were launching ways, and human power was distributed all along the line. In case of the breaking of the cable ropes were ready at hand to be used with the tugs alone. A successful start was made, and by 10 o'clock nearly 100 yards of the mass was projected into the river. Then the strain on the cable proved so great that a wait was made for slack-tide, which was about 4 o'clock. From that time forward the work was rapidly pushed, and did not cease till the end of the main was securely rested on a stone abutment waiting to receive it on the island. Water was let in soon afterwards, but turned off as soon as it was perceived that the experiment was a success. Yesterday was spent in securing connection with the reservoir on the island, and general completing performances.

The Proposed Introduction of Water Meters in Cities.

The city authorities of Brooklyn are manifesting some apprehension regarding the enormous waste of water in that city. That a vast and unnecessary drain is thus made upon the supply is fully evidenced by the fact that the amount now used averages fifty gallons per day for every individual of the population, and it is in view of the circumstance that the present yearly consumption would soon exceed the capacity of the reservoirs, now 40,000,000 gallons, and necessitate the incurring of heavy additional indebtedness of the city, that the municipal government is seriously considering the introduction of water meters. It is estimated that the expense of these appliances, extending their use into families, would be about $1,000,000, and the yearly cost for repairs some $100,000. All manufacturing establishments in Brooklyn are metered at the present time, and are paying at the rate of two cents per hundred gallons.

We notice that the Commissioner of City Works makes reference to the fact that numbers of the water meters now in use have cost with their connections from $50 to $70 each. This sum, he justly believes, is unnecessarily high, and considers that suitable apparatus may be obtained at less figures. The subject of introducing water meters in New York has also been discussed for some time, and will eventually be adopted. It would be well for inventors to turn their attention to this matter, as there will be a large market opened for cheap and efficient forms of water meters one of these days.—*Scientific American.*

Mr. O. Zollicoffer, President of the Meiropolitan Gas-Light Company, had an interview with Commissioner Van Nort on Saturday last, to ascertain whether a satisfactory arrangement could be made between the city and the gas company, whereby the latter might obtain payment of what is now due them—nearly a million dollars—and an assurance of prompt settlement of their accruing bills. Mr. Zollicoffer said that the companies are agreed, unless soon relieved of this embarrassment, to give formal notice that they would stop furnishing gas for the lighting of streets and public buildings.—*N. Y. Sun.*

Chemical Repertory.

No. 89.—April 2, 1873.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

677. Earliest Discovery of Gas-lighting on the Continent.—From a communication published in the *Moniteur Belge*, of Jan. the 13th, 1873, it appears that Pierre-Henri Minkelers, born at Maestricht, December 9, 1748, Professor of Chemistry and Physical Sciences, at Leuven (Louvain) University, from 1772 to 1797, when the University was suppressed (it was re-established in 1831 as the Catholic University of Belgium), made a series of experiments, which resulted in the discovery of gas-lighting on October 2, 1784. This is recorded in a small volume, now very rare, a copy of which is preserved in the library at Maestricht, entitled, "Memoire sur l'Air Inflammable tire de Differentes Substances," redige par M. Minkelers, Professeur de Philosophie au College du Faucon, Universite de Louvain: Louvain, 1784. After the suppression of the University, Minkelers was, for a series of years, Professor at the Atheneum of Maestricht, where he died July 4, 1824. One of the streets of the city alluded to, viz., that wherein Minkelers resided, has been named after the *savant*. Owing to the political disturbances of the time gas-lighting was not then introduced on the large scale.

678. Another Aniline Color.—F. Hamel.—When aniline is treated at the ordinary temperature with chloride of sulphur, there is formed a red-colored pigment, which is soluble in acetic acid, alcohol, and ether, but water cannot be added to these solutions, as a gray-colored matter is then precipitated from the solution. The chloride of sulphur should be cautiously added to the aniline, otherwise it becomes carbonized. The red pigment is a solid body, and after evaporation of its solution in alcohol, it is obtained as a deep black-colored crystalline substance.—*Academy of Sciences.*

679. Action of Sulphur and Hydrochloric Acids on Iron and Steel.—Mr. William H. Johnson, B. Sc., called attention to the action of sulphuric acids on iron and steel. If, after immersion for, say, ten minutes in either of these acids, a piece of iron or steel be tested, its tensile strength and resistance to torsion will be found to have diminished. Exposure to the air for several days or gentle heat will, however, completely restore its original strength. On breaking a piece of iron wire after immersion in sulphuric acid, and gently moistening the fracture with the tip of the tongue, bubbles of gas arise causing the wetted portion to appear to boil. The most careful washing and coating with lime, after being dipped in the acid, and even its subsequent drawing, in which process it is reduced in diameter by passage through a die, does not interfere with either of these phenomena; which only gradually disappear by exposure to the air, or more quickly by gentle heat. Prolonged immersion in acid has a tendency to produce a crystalline structure in even the best wrought-iron.—*Proceedings Manchester Philo. Soc.*

680. Tracing Paper.—A convenient method for rendering ordinary drawing paper transparent for the purpose of making tracings, and of removing its transparency so as to restore its former appearance when the drawing is completed, has been invented by G. Puscher. It consists in dissolving a given quantity of castor-oil, in one, two or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge, The alcohol evaporates in a few minutes, and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or india ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original capacity. The alcohol employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet.—*American Artisan.*

681. Color Blindness.—An instrument has been invented in Germany for testing color blindness. It consists of a rotating apparatus, which moves a disk, whose center is a circle, one half black and the other white; outside of this is a ring half red and half green, then another ring of violet and red, then the outside ring of violet and green. When rapidly rotated, the center appears to be colored gray, then is black and white mixed. To a green blind person the middle line will appear gray, that being the result to him of a mixture of violet and red. The outer ring will appear gray to the red blind patient, and the inner, gray to the violet blind. By the use of this instrument a large number of patients may be simultaneously examined for one or more kinds of color blindness.

682. Gas Purification.—A communication, by T. Kingzett, on "The Formation of Disodic Sulphide, by the action of Dihydric Sulphide upon Sodic Chloride at High Temperatures," was read. The author finds that when coal gas containing hydrosulphuric acid, or this gas in a pure state, is passed over sodium chloride heated to redness, a considerable portion of the salt is decomposed, the product being sodium sulphide. After thanking the author for this communication, the President observed that it would be of considerable interest to determine the exact amount of sodium sulphide formed under given physical conditions.—*London Chemical Society.*

683. On Slow Combustion.—P. J. Van Kerchoff. This rather lengthy article is from the "Archives Neerlandaises des Sciences Exactes et Naturalles." The author has examined and compared the oxidizing actions of platinized asbestus, pumice-stone, and pipe clay on carbonic oxide and coal gas in presence of a known proportion of pure oxygen. Some of his conclusions are that the combustion of these two gases is perceptible only when the experiment is continued for some time; that platinized asbestus acts most powerfully; that heating hastens the action; that, in the case of carbonic oxide, pumice stone acts at a lower temperature than pipe clay; in case of coal gas, the pipe clay is the first to act.

684. Electro-Positive State of an Insulated Candle Flame.—When an insulated flame is placed between the balls of a discharger connected with the positive and negative conductors of an electrical machine, the flame is attracted towards the negative pole so strongly as to ignite a piece of phosphorus attached to that pole. If a piece of burning phosphorus be placed between them, the phosphorus on the positive ball soon burns, and the long column of phosphoric acid vapor is also attracted to it, and forms with it the phosphate of the metal.—*Scientific American.*

685. On the Use of Bistlphide of Carbon for Removing the Grease from Wool.—From an article in the *Wollengewerbe* on this subject, it appears that bisulphide of carbon is not suitable for this purpose. When this substance is used, the wool becomes harsh and brittle, and easily turns yellow. This is not the case when benzine is used for the same purpose. It is probable that the bisulphide of carbon at elevated temperatures forms some combination with the sulphur that is naturally contained in the wool, and thus destroys the organization of the fibre. This difficulty might be overcome by removing the bisulphide of carbon at a low temperature, by the use of steam, warm water, or air; but it is not possible to do this except by methods and apparatus that will make the proceeding altogether too expensive.

686, Washing Powder.—Carbonate of soda, 94 grms.; Pearl ash, 16 grms.; Chloride of sodium. 10 grms.; Blue, ½ grm. Dissolve in 13 litres water with six ounces of soap. Boil the linen in it for half an hour, and then rinse in hot water.—*Amer. Chemist.*

687. NAPOLI'S MACHINE FOR THE DETERMINATION OF LUBRICATING POWERS OF DIFFERENT MATERIALS.—A description of the machine employed on the Eastern Railway in France, from which the following results were obtained:

Oil Employed.	Length of Time.	Work absorbed in Kilos.	Incr. temp. dur'g expt.
Animal oil	2 hours	5·200	10°
Oil (Durou)	2 "	2·700	7
English oil	2 "	2·133	13
Whale oil	5 "	7·000	10
Impure Colza	2 "	1·000	0
	2 "	7·001	41
	1 h. 50 m.	8·400	33
	2 hours	8·700	48
		8·650	43

—*Ibid.*

688. EUROPEAN PETROLEUM OIL.—Dr. G. Feichtinger.—It appears that, in Galicia, large quantities of the petroleum (in every respect like the American) occur, and, according to an investigation made by competent engineers, the country alluded to will soon be able to compete with the foreign trade in this article. Well-boring is actively pursued in several localities, but none have as yet reached the main oil-bearing strata, which are known to be at depths varying from 1000 to 1500 feet below the surface.—*Chemical News.*

689. APPLICATION OF THE MONOCHROMATIC LIGHT Produced by Sodium Salts, for Ascertaining the Change of Color of Tincture of Litmus, in Alkalimetrical Assays.—L. D'Henry.—The description of a Bunsen gas burner, so arranged that the flame is kept constantly saturated with sodium, so that while the blue color of litmus appears deep black, the red color, produced by the addition of an acid, appears as color less as water; thus affording a better means of ascertaining the precise moment when the alkali is saturated.—*Academy of Sciences.*

690. TO DETECT AN ADMIXTURE OF ALCOHOL IN VOLATILE OILS.—R. Bœttger recommends to agitate the suspected volatile oil in a graduated tube, with an equal bulk of pure glycerine, spec. gravity 1·25, which is readily soluble in alcohol, but does not combine with the volatile oil. The diminution in volume of the latter indicates the amount of the admixture.—*Amer. Jour. Pharm.*

691. TREATMENT OF AMMONIACAL GAS LIQUOR.—To half a bushel of well dried sawdust, an equal amount of clay is added, and the mixture moistened with two quarts dilute sulphuric acid (one to three of water). To this add three gallons of gas liquor. Lime from the purifiers may be used, the acid then being diluted one to five of water. An excellent fertilizer. —*Amer. Chemist.*

692. ESTIMATION OF CAMPHOR IN ALCOHOLIC LIQUIDS.—Hager distils the liquid in a water-bath, the distilled alcohol containing the greater part of the camphor, is mixed with an equal volume of water and agitated with one-tenth volume of bisulphide of carbon. After separation, a portion of the hydroalcoholic liquid is returned to the flask and redistilled from a glycerine bath at 110° C. The distillate contains all the camphor, is added to remaining mixture and bisulphide of carbon, mixed with more water and twice agitated with carbon bisulphide. The latter solvent has taken up all the camphor and volatile oils if present. This solution is evaporated spontaneously in a tarred glass dish with straight sides at an atmospheric temperature not exceeding 45° C., the temperature of the dish being lowered by the evaporation to 5 to 10°, preventing the evaporation of the camphor almost completely, while the volatile oils evaporate freely. Should a larger quantity of volatile oils be present, the residue must be again treated with carbon bisulphide in the same manner, until a solid residue is left, when it is immediately weighed. In the presence of oil of lavender, and particularly of rosemary, the camphor is obtained in prisms.—*Amer. Jour. Pharm.*

693. COLORING LEATHER WITH ANILINE COLORS.—These colors can be most readily fixed upon leather. The phenyl and naphthaline colors are readily fixed by simply dipping the leather in a solution of the color. Fuchsine acts in the same way; that with a yellow shade is preferable. For a scarlet, brushing with a slightly acidified aqueous solution of coralline, and then with a solution of fuchsine, is necessary. The Turkey red color, less fast, is obtained by using red coralline alone. Orange is best obtained with acidified coralline. Picric acid and fuchsine are not to be recommended to produce this color. To color blue, Nicholson's blue especially, and blues soluble in water, are recommended. The surface should be brushed over with a solution of one ounce of Nicholson's blue in about 4 lbs. water, and the leather should then be passed through a bath containing 10 c.c. sulphuric acid to every litre. For violet, the dahlia violet and violet de Paris are the best; as with fuchsine, the leather only requires to be dipped in an aqueous solution of the one or other. Iodine green, in aqueous solution, applied with a brush, will color leather green; the shade may be varied by the use of picric acid. For browns, aniline Bismarck and Manchester brown are the best. Grenade gives red with a blackish cast. Induline gives a fine silver-gray hue. Chrysaniline gives a fine orange, but is extremely expensive.—*Am. Chemist.*

694. MANUFACTURE OF SULPHATE OF AMMONIA.—The ammonia is volatilized by heating urine in close vats, and the gas passed into sulphuric acid. The salt is crystallized and dried.—*Amer. Chemist.*

Report of Chief Engineer John P. Culver, of the Bureau of Engineering and Surveying of Jersey City.

[The question of the water-supply of the New Jersey cities, which are growing at least as fast as any of the suburbs of the Metropolis, is now looming up into importance. We shall extract quite copiously from a very able report for the year 1872, of the Engineer of the Jersey City Board, which is replete with matter of interest bearing on water-supply generally.

It may be proper to say also in this place that the Editor of this Journal has been occupied for several months in an exhaustive examination, chemical and sanitary, of the water of the Passaic River, and of the water-shed of the same; which is now being printed by the Board of Public Works of Jersey City, and will be laid in substance before our readers, after its issue.—ED.]

To the President and Board of Commissioners of Public Works:

WORK OF ENGINES.

Gentlemen—During the past year the engines at Belleville have worked 11,333 hours 11 minutes, made 6,822,041 strokes, and pumped 3,502,333,494 gallons of water.

COAL.

The total quantity of coal used was 4,472½ tons, of which 202 tons were used in banking fires.

AVERAGE DUTY.

The work accomplished was 467,352 lbs. water raised 1 foot with 1 lb. coal.

WASTE OF WATER.

The wastage of water before alluded to still continues.

The amount of water drawn from the distributing reservoir during the night often far exceeds the average used in the day time. This fact has been particularly noticeable this season, the water line in the reservoir falling with the mercury in the thermometer. On several occasions the qurntity of water drawn off between the hours of seven o'clock, P. M., and seven o'clock, A. M., was in excess of eight millions of gallons.

The lavish use of water is not confined to this locality; complaints of waste are universal, and the deplorable results which must follow are freely commented upon by all conversant with the question. There appears to be but one way to obviate this difficulty, and the opinion entertained by hydraulic engineers that the application of meters to every house is the sole solution, is being concurred in by the authorities. If the consumers will persist in wasting water they should pay extra rates for the excess above a liberal allowance.

Year Ending.	Daily av'age —Cu. ft,	An. Consump. —cu. ft.	Per ct. of increase.
July, 1858.....	188,666	68,863,050	.....
" 1859.....	230,684	84,199,813	.22279
" 1860.....	267,992	97,817,062	.16173
" 1861.....	288,872	105,438,394	.07791
" 1862.....	308,445	112,582,478	.06775
" 1863.....	340,344	124,225,867	.10342
" 1864.....	406,127	148,236,333	.19328
" 1865.....	478,385	174,610,667	.17792
" 1866.....	540,307	197,212,222	.12944
" 1867.....	573,276	209,246,015	.06101
" 1868.....	628,001	229,220,661	.09546
Jan., 1870*.....	810,665	295,892,887	.29086
" 1871.....	923,323	337,014,354	.13897
" 1872.....	1,036,407	378,288,541	.12247
,, 1873.....	1,279,307	468,226,403	.23437

* 18 months.

RIVER CONDUIT.

The working of our Cornish engines has during the past year been often interfered with and sometimes entirely stopped on account of the low stage of water in the river. This is attributable to two causes:

Primarily, the action of the United States in removing the bar, which while it obstructed navigation acted as a dam to retain the water between tides; and secondarily, the elevation of the river conduit. If the taking away of a portion of the bar so sensibly affects our works, its entire removal (which is projected) may seriously inconvenience us.

The capacity of our works is restricted by inability to use two or more engines, except at high tides, and the result may be that either the present river conduit will have to be deepened, or an additional one built.

While we have pumps competent to raise into the receiving reservoir double the quantity of water we are now using, and when the new conduit is finished would be able to gravitate same to the distributing reservoir, yet the magnitude of our works must be measured solely by their actual effectiveness, which is dependent upon the volume of water flowing through the river conduit into the wells.*

Should the working of the Duplex engine materially reduce the quantity of water furnished the Cornish engines, you will be informed of same, and such action recommended as the case requires. Until however the Duplex engine is working, I prefer to hazard no suggestions nor indicate any extension of works which must ultimately be abandoned.

FORCE PIPES.

The new arrangement of pipes so that either engine can pump into old or new stand-pipes, in conjunction with old or new rising main, is completed. This system comprises 428 feet of 36-inch pipe in connection with Cornish engines, and 45 feet of 30-inch pipe connecting the Duplex engine with new main. Eleven 36-inch gates, and one 30-inch check-valve were necessary to properly regulate these connections.

All of the above is new work with the exception of 77 feet of 36-inch pipe and three 36-inch gates one of which was set prior to April, 1871, and two inserted in places of others disabled.

NEW BOILERS.

The new Cornish boilers contracted for in 1871, and an additional one made last year, have been set up in the extension to the boiler house (which is finished). The steam drum and pipes are attached but not yet connected with the old boilers.

THE NEW STAND-PIPE TOWER.

The tower inclosing the two stand pipes is finished, with the exception of painting the galvanized iron roof and cornices, and the erection of the staircases and railings.

* This is the engine so well known to our readers as the Worthington Duplex. We propose to collate some of Mr. Culver's experience with this pumping engine in an early issue.—ED.]

The dimensions of this tower are as follows:

Concrete foundation, 2 feet thick; height of base from foundation to top of water table, 23 feet 6 inches; pedestal from water table to top of belting course, 38 feet; from top of belting course to top of small table, 2 feet 11 inches; top of small table to top of balcony course, 62 feet 2 inches; top of balcony course to top of brickwork, 58 feet; height of observatory, 25 feet 6 inches; total height, 210 feet.

The plane dimensions at different elevations are as enumerated:

Concrete foundation, 66 × 51 feet; base of tower, 62 × 47 feet; water-table, 46 × 31 feet; top of water-table, 44 × 29 feet; under side of belting course, 42.3x 27.3 feet; belting course is 2 feet thick by 4 feet wide and overhangs 2.6 feet) top of belting course, 38.6x 22.7 feet; top of small table, 36.6 × 21.7 feet on outside and 28 × 13 feet on inside.

From the concrete foundation to the upper side of small table (61 feet 5 inches) the tower is one solid mass of masonry, excepting the stand pipes, base castings, and influent and effluent pipes.

The stand pipes are each 6 feet in diameter and set 15 feet from centers.

From the top of small table the walls are double, the inner walls being carried up plumb while the outer walls have a batter of about one-forth inch to the foot.

At the balcony the tower is 34.2 × 19.2 feet; (the balcony course is 10 inches thick by 5 feet wide and overhangs 3 feet.) At the top of brickwork the tower is 31.6 × 16.6 feet.

The floor timbers of the observatory are 81 × 2 inches, bolted to brick-work, and overhang 3.6 feet. The size of the observatory is 27 × 12 feet, The trimmings are all of freestone quarried at Belleville. Sixteen bands of $\frac{1}{4} \times 2$ inch iron encompass the tower, pierced with $\frac{3}{4}$ inch holes every 2 feet, in which are inserted $\frac{3}{4}$ inch wrought iron pins 8 inches long.

Four courses of forked tie rods of two inch round iron, with plates on each end 8 inches wide by 4 feet long, are anchored in the base of tower to insure the bond between the old pedestal and new masonry, the first and third courses having a bolt on outside of each stand pipe, the second and fourth courses a bolt between and on outside of pipes at right angles with odd courses. Three courses of flat iron bands with pin anchors are bedded in the base between the top line of old pedestal and belting course of tower. The masonry work is first class throughout, and there is not a crack in the entire structure.

The stand-pipe room is so thoroughly warmed by means of a single steam pipe that even in the coldest weather no ice has formed in the stand pipes. The force pipe and gate room at the base of the tower is heated by means of steam in two coils of six pipes each, the pipes being $1\frac{1}{2}$ inches in diameter and 12 feet in length. The application of steam for this purpose proves superior to the coal stoves heretofore in use.

[To be continued.]

The Croton Water.

The following is a report by Mr. E. H. Tracy, Chief Engineer of the Department of Public Works, to Commissioner Van Nort on the subject of an increased supply and distribution of Croton water in this city:

DEPARTMENT OF PUBLIC WORKS,
CHIEF ENGINEER'S OFFICE, 235 BROADWAY,
NEW YORK, March 7, 1873.

To GEORGE M. VAN NORT, ESQ., *Commissioner of Public Works.*

Sir: In answer to your inquiries in relation to the necessity of increasing the facilities for the distribution of Croton water throughout the city, in order to deliver with high head and in large volume, and also on the possibility and probabilities of being able to procure an abundant and never-failing supply from the Croton, even if large territorial additions be made to the limits of the city, and as to the necessity of any immediate action being taken to supply salt water for fire and other purposes, I would respectfully submit the following report:

Before the Croton Aqueduct was constructed, its designers and constructors made very elaborate investigations to ascertain what amount of water would be required for a bountiful supply for the city of New York, and arrived at the conclusion that thirty six United States standard gallons daily for each inhabitant would be all that would ever be required. They also came to the conclusion that this city, within its present boundaries, might ultimately contain two millions of inhabitants. On this basis they decided to build the present Croton Aqueduct, supposing its capacity would be 72,000,000 gallons daily.

Previous to the construction of this aqueduct there was no record of any system of experiments on the flow of water in channels constructed with the care and skill that the Croton Aqueduct has been to offer the least resistance to the water flowing through it. Its capacity was calculated from the results of the best experiments that had been made by the most accomplished engineers of Europe, who had made the flow of water through channels the study of their lives, and the results thus obtained were confirmed by the experience of American engineers on the flow of water through canals. The Croton Aqueduct, owing to its good form and accuracy of construction, has a capacity of delivering 115,000,000 gallons daily (this has been ascertained by careful experiments made by this department to ascertain the velocity with which the water flows through it), being 60 per cent. more than its estimated capacity. The system of mains from the reservoirs south were laid with a view of supplying thirty-six gallons daily to each inhabitant, and it was assumed that the ultimate population south of Murray Hill would be 700,000, or that 25,200,000 gallons per day would be an ample supply, and until a greater amount of water was used than was anticipated under this arrangement of mains a good head of water was at all times maintained in the lower parts of the city. The daily consumption of water has been steadily increasing year by year.

The aqueduct has now been in use more than 30 years, during which time no material failure has occurred in it, and it is not probable that any will occur that will require, with proper energy, more than a few hours to repair. With the increase of consumption of water there has not been a corresponding increase in the capacity of the mains. The addition of two mains (one on the eastern and one on the western side of the city), four feet in diameter, from the reservoirs in Central Park to the lower part of the city, together with some additional large lateral mains, will obviate this difficulty and restore the head to the same condition that it was when the water was first introduced. In the original laying of many of the smaller street mains, pipes were put in which are entirely inadequate for the present wants or necessities of the inhabitants. For instance, Fifth avenue, between Fifty-eighth street and Washington square, and Church street, between Canal street and Fulton street, are supplied only by six inch mains. These two localities are mentioned because one of them is filled with the largest and most costly residences, and the other is lined on both sides by some of the largest warehouses in the city, which are filled with most valuable and most combustible goods. There are many other districts in the city which require additional means for the protection of lives and property, and for industrial purposes, as well as for the ordinary comforts of life of those residing or doing business in them. It is proposed in laying the new mains to connect them with each other and with the present mains, in order that an inexhaustible supply with a large head may be thrown in any district of the city in case of any unusual conflagration. The amount of water consumed in the extinguishment of fires is not so large as is generally supposed. There are at present about forty steam fire engines in the city, of a probable capacity of not more than 25,000 gallons per hour each, or a total of 1,000,000 gallons per hour. It is important to be able to throw streams directly from the hydrants on buildings of moderate height in addition to those thrown by the steam fire-engines; the proposed arrangement of new mains will enable this to be done as well as it was when the water was first introduced. It is of vital importance to the city that these additional mains be laid at the earliest practicable day. For many years past the department has kept a gauge of the daily quantity of water flowing over the Croton dam in addition to that which is conveyed to the city by the aqueduct, and during the past ten years an average daily quantity of 340,000,000 gallons has run to waste over the dam in addition to the quantity that was brought to the city. There has been but one year in the last ten when a storage reservoir capacity of over 21,000,000,000 gallons would have been required in the valley of the Croton to have furnished 200,000,000 gallons daily, in addition to that brought in by the Croton Aqueduct. The exceptional year was that of 1870, when it would have required a storage capacity of 30,000,000,000 gallons. There are plenty of natural sites in the valley of the Croton for constructing storage reservoirs on the lines of streams where they would certainly be filled during the wet seasons, that would have a capacity of more than the required amount. There can therefore be no doubt that three times the present quantity of water can be got from the valley of the Croton, but to bring any considerable amount of water from the Croton River to the city will involve the construction of a new aqueduct in Westchester county.

That part of the present aqueduct in Westchester county cost less than $5,000,000 to construct, including the right of way. This is a less sum than a four feet cast-iron main can be laid for in the same distance, and which, if laid on the same grade as the aqueduct, would not carry over one-sixth of the quantity of water. To construct a new aqueduct to carry twice the quantity of the present one would require no more right of way than the present one, and not more than twice the quantity of masonry in construction, and it is highly probable that a better line can be found to construct it upon than one near the location of the present aqueduct. As to the immediate necessity of introducing salt water, I would respectfully refer to my report to you of November 16, 1872. The use of salt water for extinguishing fires, unless in case of a large conflagration, is objectionable, as in fires of no great extent there is more damage done by water than by fire, and the wetting of many kinds of valuable and perishable goods by salt water would ruin them, while being wet with fresh water would but slightly damage them. I have no doubt that the supply of Croton water can be increased to 300,000,000 gallons per day for an amount that will not exceed the cost of introducing 100,000,000 gallons per day of salt water to be pumped up by steam power from the rivers. All of which is respectfully submitted.

Yours, EDWARD H. TRACY, Chief Engineer.

[To be concluded.]

Self-Regulating Water Supply.

To the Editor of the *American Artisan:* New York City seems anxious to obtain a water supply for fire purposes that shall be both economical and practical.

Binghampton thought so once, and has been very successful in obtaining the end desired.

We have a constant supply of water for fire and domestic purposes, with *a changeable head, at will,* from 1 to 120 feet pressure, controlled by an automatic regulator located in the pump-room and governed by the opening and closing of a hydrant and without dependence upon either a reservoir or a stand-pipe both too expensive luxuries, and unnecessary as has been fully demonstrated in our city.

Our works have cost us about $150,000. We have over twenty miles of pipe, and have nearly done away with the old fire department, depending upon the hose companies for the suppression of fires, all that is required being to attach the hose to a hydrant, turn on the water, and in three minutes time there is a full head at every hydrant in the city, which, if needed, can be confined to the immediate precincts of the fire.

The system is scientific and entirely practical. The power consists of suitable boilers and engines, located near the Susquehanna river.

The water is forced directly into the main pipe and distributed thence through the service pipes.

The pumps used are "Rotaries," the inflow being without the *thud* that follows the stroke of a direct-acting piston-pump, thus relieving the pipes from the intermitting blows so disastrous to pipes and joints.

Our pipes are *stove-pipes, i. e.*, rolled iron pipes with riveted joints, lined with the best water cement, and are very durable.

As before stated, the pressure is regulated at will by the *demand made for water* and is absolutely controlled from this demand.

Hoping this information may be of use, I remain,

Yours, ALFRED C. POPE.

BINGHAMPTON, N. Y.

Illumination—Some of its Modern Aspects.

By Dr. WM. H. WAHL, Sec. of the Franklin Institute.

[Communicated by the Author.]

[Continued from page 92.]

Continuing the discussion of the modern innovations in the field of illumination, certain methods, by which the light oils of petroleum (gasoline especially) are made use of, to improve the illuminating power of ordinary burning gas, warrant attention. These processes are essentially the same in principle, though differing very greatly in the details of the devices in carrying out the idea; and when carried into effect with certain obvious precautions, which will be referred to hereafter, are, to some extent, though by no means entirely, free from the vital objections on the score of danger, upon which so much stress has been laid in the preceding pages of this paper. And the writer begs leave, once for all, to state his firm conviction, that it would prove a matter of inestimable benefit, if some method should be discovered and applied, either for converting these volatile bodies into useful and harmless compounds, or if some process should be devised for utilizing them largely in the industrial arts. By either of these remedies the direct employment of the light oils for household illumination could be altogether avoided; since, though the ingenuity of invention may be exercised to devise preventives and precautions against accident with them, it is very gravely to be doubted, from the very nature of the materials, whether they can ever be so employed with a reasonable degree of safety.

The philosophy of the processes here referred to will be more clearly understood, by a general reference to the principles involved in the utilization of illuminating agents. These are generally compounds of carbon and hydrogen, the so-called hydrocarbons, and are either already in the gaseous state, or are converted to this condition in the process of burning. A certain proportion of these elements is, however, necessary, in order that the illuminant shall burn with proper brilliancy. To the hydrogen of the burning body, is to be mainly ascribed the heating power of its flame, while to the carbon alone are we indebted for its illuminating qualities. It is, therefore, possible that a hydrocarbon may possess too much hydrogen in proportion to its percentage of carbon (as is the case with alcohol, for example), when the effect will be that of a hot flame, but almost or entirely blue, and with little or no light-giving power. Or, on the other hand, the burning body may contain an excessive proportion of carbon (as is the case, for example, with turpentine oil), when the result will be a dull red, dirty, smoking flame, which, though giving out more light than the first, is utterly objectionable on the score of the abomination of its smoke. It is, therefore, a matter of the first importance that, in an illuminant, these essential constituents shall be present in such proportions as shall produce the best illuminating effect.

With the common burning gas, the reason of its very general inferiority is to be referred to the large percentage of the light carburetted hydrogen gas and of free hydrogen itself, which it contains. The rationale of the introduction of these feeble or non-illuminating ingredients into the gas, is not difficult to comprehend, if a glance be taken at the operation of its manufacture.

In the process of obtaining burning-gas from fat coal, which is the one almost universally employed in gas-works, the rich, light-giving gas is evolved during the earlier portions of the heat; but, owing to the natural desire of the companies to secure from a charge the largest quantity of gas, the heat is continued for a considerable time after the richer portions of the gas have passed off; the consequence of which is, that the gas passed over into the holder during this period is very largely composed of hydrogen, which has no illuminating power, and of the light carburetted hydrogen, which is not much better.

The fact that the gas supplied for household consumption is generally but of indifferent quality, mainly from the cause specified above, has originated a number of plans for improving its brilliancy, by supplying it indirectly with a portion of the constituent in which it is lacking, namely, carbon. This process involves the passage of the gas, before consumption, through a reservoir of some one of the light petroleum oils, preferably gasoline, on account of its eminent volatility; by which treatment it becomes charged to saturation with the vapor of this material, the illuminating power of which is very superior, and comes to the burner greatly improved in quality. This process, which bears the name of "carburetting," has received, in several cities, a limited introduction. The volume of the gas is by this process considerably increased, as well as its illuminating power; and this, together with the cheapness of the carburetting material, the smaller quantity of gas which need be consumed to produce a given amount of light, as compared with that which would be required without its presence, combine to considerably reduce the expense of employing gas—an item, it must be granted, of no inconsiderable importance in large establishments where a large number of burners is regularly in operation. And it is in such establishments that this plan, or others, which will presently be alluded to, have been received with the most favor. Where a limited number of burners is in requisition, as in smaller workshops, stores, or private dwellings, the saving which may thus be effected in the item of expense, is scarcely a matter sufficiently important to offset the disagreeable routine of attention which it is necessary to devote to the apparatus to keep it in effective operation. Other incidental difficulties, such as the natural hesitation on the part of those familiar with the unavoidable risk entailed upon the handling of the carburetting material, and perhaps the still more cogent reason, that the insurance interests have, in most localities, prudently refused to sanction or permit the introduction of the process, in connection with risks assumed by them, have so combined to limit the application of the process of carburetting, that it is, though not new, still comparatively unknown to the general public.

Although the introduction of any of the lighter oils of petroleum into buildings for illuminating purposes, will be discountenanced by all who seriously and candidly reflect upon the unavoidable risks that attend their employment, it must still be granted that, if these substances are to be employed at all, this and allied plans, in which the inflammable material is securely confined in a metallic reservoir, is infinitely to be preferred to the practice of using it in the portable lamp.

In connection with the modern processes for utilization of the light petroleum oils, there remains yet to be reviewed a number of plans by which this is accomplished directly; although, through the intervention of appliances considerably more complex than the portable lamps. Reference is here made to the numerous devices which are popularly termed gas machines.

These consist, in general terms, of a reservoir, generally a strong metallic vessel, supplied with the oil to be utilized, through or over which a regulated supply of air (or in some cases of hydrogen) is passed, the illuminating agent resulting from this contact being then led, by the usual distribution-pipes, to the burners. In the simplest form of apparatus operating upon this principle, this result is accomplished by permitting the gasoline vapor, which is considerably heavier than the air, to fall, in virtue of its gravity, down a descending pipe, and thus, by the current established, induce a flow of air over the surface of the oil. The material is suitably contained within a reservoir provided with an opening at one extremity, to permit of the access of the air, and further, with a series of alternating, imperfect partitions. The object of the latter is to increase the amount of contact between the entering air and oil, and to effect what would be equivalent to a large evaporating surface. The more rapidly the gas is consumed from the burners the more rapid will be the evaporating process, which will, of course, cease as soon as the burners are turned off. Thus, by ingeniously taking advantage of the extreme volatility of the light oil, an air-current is induced, by which an abundant supply of excellent illuminating gas is obtained automatically, without the introduction of any appliance other than the reservoir with its simple partitions. This plan, though very interesting, from its simplicity and the scientific principle which it so ingeniously illustrates, involves the serious necessity of placing the reservoir of oil in the upper story of the building to be lighted. The plan here briefly described contains all the essential features, though the object is attained in the simplest possible manner, of all the numerous gas-machines. In the others, a fan or its equivalent is employed to blow into the reservoir a stream of air. Though somewhat more complex in construction, this form of the apparatus is less objectionable than that first described, from the fact that the reservoir of oil may be located at a considerable distance from the house, and beneath the ground, in a pit prepared for the purpose—thus lessening the risk by lessening its proximity to the building endangered by its presence; though, with all of them, the personal dangers attending the replenishing of the reservoir remain the same, as does also the liability to explosion, when, from an accidental deficiency of oil in the reservoir, or extremely cold weather, a defect in the proper working of the apparatus, or from any other cause, an excess of air is introduced by the blower. Where such a condition of things occurs, an explosion is the inevitable consequence, since the instant the proper mixture of air and vapor is reached, the combustion of the gas at the burners will dart instantly back to the reservoir with all the explosive violence of gunpowder. This contingency is by no means impossible—indeed, it is unfortunately only a too frequent occurrence.

With the hydrogen machine, where a current of hydrogen gas (generated, in an appropriate vessel, from the action of diluted sulphuric acid upon iron scrap), is passed through the reservoir of oil, though it seems not to be so liable to an accident from this source, and affords a light much superior to that obtainable with the other forms of machine, is more obviously objectionable, on the score of complexity of the operations involved in its working, not the least of which consists in the replenishing, from time to time, of the generating vessel; an operation which, from the character of the acid and its use, is a most disagreeable one. Another objection, however, which far more effectually extinguishes the possibility of this process ever gaining popularity, resides in the fact that the gas obtained by it costs, to say the least, three times as much per thousand feet as the ordinary burning gas. The sale of the refuse to the manufacturing chemist, for the extraction of the green vitriol, and the diminution in the quantity of gas consumed, by reason of its excellent illuminating quality, may effect a slight reduction in the grave item of expense, but this will, even under the most favorable circumstances be too great to permit of any other than a very limited introduction.

With this somewhat lengthy consideration, the gas machines may be passed by; though, in conclusion of this branch of the subject, a few words upon their merits may not be thrown away.

They possess, one and all, the objectionable feature of employing the incendiary petroleum oils; and though they, as a class, reduce the danger of its presence to a minimum, by confining the material in a strong metallic vessel, and by locating this at some distance from the buildings to be lighted, the danger is but incompletely provided against, as has already been pointed out, and the personal risk involved in the execution of the routine of attention which they demand, remains.

In the foregoing pages, the entire unfitness of the light petroleum has been urged, under whatever name, or with any form of lamp or machine, as illuminating agents, from the belief that under no circumstances can these substances be so employed with a reasonable degree of safety. Upon the least objectionable modes of their application, namely, in the carburetter and the gas machine, the writer was, until lately, of the opinion that they might, with the exercise of well-defined precautions, be used with a reasonable degree of safety; but a thorough examination of the matter, with the knowledge gathered from a more extended acquaintance with the statistics of the subject, has prompted a revocation of that opinion and this expression of it.*

There is no field, at present, in which invention would prove of such eminent service to the communi-

* The Editor of this Journal, while entertaining high respect and regard for the views of Dr. Wahl, cannot but crawl at this sweeping decision; and asks for further time and experiment to settle the questions here involved.

ty at large, as in that of devising methods by which these oils would be utilized upon a vast scale, and thus effect their withdrawal from those applications, in which their dangerous vualities are so prominently involved, to the constant peril of life and property. That this object will ultimately be accomplished there can be no doubt. Already, large quantities of these materials are exported to be converted into permanent illuminating gas, by a process analogous to that employed in our gas-works, the retort and its setting being modified to suit the purpose. Their utilization in other departments of the industrial arts is gradually extending, and it is sincerely to be wished that the time is not far distant when the demand for them in these legitimate fields of employment will be more than sufficient to meet the supply. As an indication that progress is being made in this direction, this article, which has grown into far more considerale proportions than were originally intended, may be appropriately concluded by a description of the most recent of all the plans for illumination, and in which the light petroleums are called upon to do good and proper service.

The plan which has been devised and patented by M. Tessie du Mothay, cosists of three distinct steps:

First, the continuous production of hydrogen-gas; Second, the passage of the hydrogen through a well of the light oils; and Third and most important, the conversion of the vapor-laden hydrogen into a permanent gas.

The first step in this ingenious invention consists in leading steam into a furnace charged with coke and heated to redness, by which process hydrogen and carbonic oxide are formed. From this mixture the carbonic oxide is removed by passing the gases through cylinders of hydrated lime heated to redness. The result of this treatment is the formation of a fresh equivalent of hydrogen, and the conversion of the carbonic oxide into carbonic acid by union with the oxygen of the decomposed water of hydration. The carbonic acid is removed from the hydrogen by passing through more lime, and the hydrogen is passed onward into another chamber, where it comes into intimate contact with a body of light petroleum oil. Here it loads itself with the oil-vapor, and continues on its course, passing next through tubes heated to a low, red heat, whereby a permanent gas is formed, precisely analogous in all its properties to the ordinary coal gas, though superior to the last (as ordinarily furnished the public) in illuminating quality.

A process which would secure to those living remote from cities, and who are necessarily deprived of the luxury of coal-gas, some substitute for the petroleum gas machine, which shall equal it in the quality of its illuminant, but at the same time shall be free from its objectionable features, would be a more direct means of effecting this much-to-be-desired result, though it afford a problem far more difficult of solution.

The subject has by no means been exhausted, though this slight contribution to its literature has grown beyond convenient limits, and the consideration of other modern innovations in this important field of applied science may afford material for a future paper.

The Coal Question in England.

The price of coal in London, while we write, is £2 8s. a ton!—an unprecedented price, one is apt to say; yet that is not so, according to a writer in the *Daily News;* for so long since as February, 1814, the war price was £2 11s. 8d.! In February, 1851, it was 12s. 3d.! The writer referred to says:

"If, to morrow, the colliery owners of Durham were to notify to the London Coal Exchange that they had resolved to raise the price of coals by 20s. per ton, remonstrance might be useless: the infliction must be submitted to. They know and use their power. It would, indeed, be unfair to charge them with 'gagging' the supply, but they are reaping the advantage of having had the supply 'gagged' for them by their workmen. To quote Sir William Armstrong, 'coal-owners have long been aware that limitation of quantity was the only effectual mode of raising price, but they have never been able by their own action to maintain a restricted production. At last their workmen have done it for them, and we see the result.' It may be added that we feel it as well as we see it. At this moment the restriction so produced is rather too tight for the coal-owners. The demand is so keen that they could sell as many coals again at full prices as they do now, if they only had them to sell. But they cannot get the colliers to win more coals than they did before, no matter how high the scale of wages may be—in fact, the work being piece-work, the get of coals diminishes in proportion to the increment of wage, since the collier is not ambitious of realizing a fortune, but is content to receive and enjoy nearly double the wage for about two-thirds of the work he was wont to do in times less prosperous. He is, it is true, in a chronic state of demanding an advance, and his demands have abstract right on their side, looking to the prices which the owners obtain; but when he gets an advance, he discounts it by winning so much less coal. So the process goes on and on, towards what climax who shall say"?

A movement is said to be on foot in the North Midland counties to press upon the Government the necessity of instituting a full and fair investigation into the increased price of coal, which is interfering materially with both manufacturing and domestic interests. It is proposed that the court of inquiry should be constituted of men of known ability and unflinching impartiality, who would call before them men from the ranks of coal proprietors, and also men connected with the colliers' unions. The object of the inquiry would be:

"To ascertain if the sole cause of the present high price of coal is the advance of colliers' wages and the short time movement, and other alterations which have been brought about in the working of coal-mines, not forgetting the charge so frequently made against the colliers, of late, that they are so idle and intemperate now, in consequence of the great wages they receive for a day's work, that the output is seriously limited."

Mr. C. Seely, Jr., M.P. for Nottingham, who is a very extensive colliery proprietor, has promised to promote this official inquiry, and to give evidence if called upon.

A new company (the Diamond Fuel Company) has been incorporated, with a capital of £200,000, in shares of £5 each, to acquire and carry out the works now in the hands of Messrs. Barker & Clare, at Stratford, Essex. The process consists in the conversion of slack or duff, coal-dust, or small coal into solid and compact blocks, in combination with ingredients which render them, says the *Mining Journal*, actually superior as a fuel to the lump or screened coal itself. The machinery used in the production of the diamond fuel is almost entirely self-acting, the material being scarcely touched from the time it is first lifted to the machine until it is ready for the market; and as it is intended to establish works and depots at Liverpool, Hull, Swansea, Newcastle-on-Tyne, Sunderland, etc., the expenses of carriage both for raw material and marketable fuel will be reduced to the minimum.—*London Builder.*

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—ED.

The Oxyhydrogen Light.

[The following has been received from a gentleman known and recognized among gas men, who nevertheless, does not wish his name to appear at present.]

March 27, 1873.

Dear Sir: When I had the pleasure of visiting you lately in New York, I promised to give you my opinion of the Oxyhydrogen process, and its relation to coal gas in an economical point of view.

The Oxyhydrogen light generally implies a compound jet of oxygen, and hydrogen gas, impinging on a pencil of zircon, lime, etc., and producing a most intense light, totally unfit for the naked eye, and consequently, not adapted as an article for commercial use. Why the company adopts the name Oxyhydrogen Gas-Light, and in general practice discards its use as above understood, to me appears rather singular; except, indeed, assuming that the public, having very little knowledge of its philosophy, and much less of its chemistry, may be induced by its novelty to subscribe liberally toward the formation of corporations for its manufacture.

I understand there is a company in Buffalo who collect oxygen from the air, produces hydrogen from the water, and rich carburetted hydrogen from naphtha vapors. They light some of the city lamps with a jet of carburetted hydrogen, somewhat like an argand burner, only that the inner aperture for the oxygen is small. Now, in the ordinary combustion of, say, coal gas, the hydrogen of the gas at its exit from the burner, parts with the carbon by reason of its greater affinity for the oxygen of the air, and produces that dark blueish non-luminous portion of the flame next the burner, and by the intensity of its heat raises the temperature of the particles of the carbon to an incandescent state. Now, while the particles of carbon remain in that floating condition, they give out the full value of their light, but as soon as they approach the edge of the flame, they immediately combine with the oxygen of the air, and are resolved into new compounds. On the same principle it appears to me that the injection of a current of oxygen into the midst of the flame, would burn an ordinary jet of gas almost as soon as it issues from the burner, and although giving a good light it is at the expense of a vastly greater amount of olefiant, or the ordinary gas mixture; for the particles of carbon are not allowed to remain in an incandescent state long enough to give out their greatest equivalent of light. To maintain then a light of sufficient magnitude for street lighting, the amount of carburetted hydrogen must be greatly in excess of that used in ordinary lighting. Professors tell us it requires certain volumes of oxygen for the proper combustion of a volvme of olefiant gas, beyond which the illuminating properties of the gas are lost to the consumer to that extent.

We will now take a view of its probable cost. At Buffalo I understand they have a very extensive building, most complicated machinery, two sets of main pipes in every street they have occupied, and two sets of service pipes to the lamps. They collect the oxygen from the atmosphere through the agency of manganate of soda, heat, steam, and condensation, at a very considerable expense, and store it in the usual way. The hydrogen they generate from water by converting the water into steam, then superheating, next decomposing it in the presence of coke; passing it through heated hydrated lime, next through an ordinary lime process for the absorption of the carbonic acid and so on; it is then passed into a heated retort, in which the naphtha vapors are decomposed, and then the two gases are mechanically mixed and stored away for delivery to consumers. At Buffalo the hydrogen, the diluent, costs at least as much as the principal. From the above you can form a correct idea of its competitive pretensions to coal gas. It is, in an economical point of view, a palpable failure. No educated gas engineer in the country, I dare say, would so far risk his reputation as to endorse the system. Yours respectfully, X. Y.

Mr. Keeling—Oxyhydrogen Gas.

KNOXVILLE, TENN., March 25, 1872.

Mr. Editor: The Gas Journals came promptly to hand yesterday. I am obliged to you for your flattering request relative to communications. It will give me pleasure to comply, although I must confess I felt rather mortified to find my last communication in such company. I refer to Mr. John Keeling, who it would seem is nothing more nor less than a professional gas agitator, and in my humble opinion, ought to be debarred the use of your columns. I cannot think of one communication he has made to the Journal that has tended to advance its interests, or promote the knowledge of the gas fraternity; on the contrary, they are characterized by a low vulgar impudence. In his last communication, February 3rd, he imputes exceedingly base motives to a gentleman who deservedly ranks high in England as a gas engineer—Mr. Magnus Ohren of the Crystal Palace Gas Company. Of course such communication can only have one tendency, which I need not state. My only motive in writing this is from a sincere desire to see the prosperity of the Journal, in which I take a great interest.

I observed a notice of the death of Mr. George Rugan (your correspondent "R,") in a Terre Haute paper about a month ago. From the notice it would appear he stood very high in the estimation of the community.

I do not know what to say about the oxyhydrogen gas. Of course just as long as there are people with more money than brains, just so long will there be

oxyhydrogen gas, and patent gas, and new gas, and air gas. Just witness that new gas company which has been started in England with a capital of £250,000—nearly $1,000,000—*and got the money*, on a thing that has been patented, tried, and failed forty times.

Yours respectfully,
JAMES SOMERVILLE, Sup't.

Comparative Salubrity of Several Illuminating Materials.

FITCHBURG GAS CO., March 6, 1873.

Mr. Editor: I find a table indicating the comparative salubrity of several illuminating materials—the flame of coal gas and the flame of several combustible bodies, that gave amount of light equal to it, burned separately in given quantities of atmospheric air, and time noted when each flame was extinguished by the contamination of the air.

Colza oil, 71 min.; olive oil, 72 min.; tallow, 55 min.; sperm oil, 76 min.; stearic acid, 77 min.: wax candles, 79 min.; sperm candles, 80 min.; coal gas, 13 candles, 98 min.; cannel gas 28 candles, 452 min.

Now, what I would like to know is, how long does oil made from petroleum, or the refined oil, compare in this particular with coal gas. Can you inform me? Also what coal gas company had a trial with the city or individual, upon which the reliability of gas meters was very fully shown, upon the trial I wish to obtain a report, if there was such a trial. Yours truly,

H. F. COGGSHALL,
Treasurer and Secretary.

An Excusable Error.

NEW YORK, March 20, 1873.

Mr. Editor: Under the above head you mention in your Journal of March 17, that as you always desire to give credit where credit is due, you feel obliged to state the receipt of a note asserting that an item copied from my paper and credited to me, was originally from the *Popular Science Monthly*, and that by examination you find this to be really the case.

I know that you have always manifested your desire to credit to writers of the articles selected for your paper, but allow me to call your attention to the fact, that I am equally driven by the same desire, and in proof I request you to examine my paper, page 19, and you will find that in the beginning of the paragraph, now accused of plagiarism, I have myself given the credit where it belongs. In doing my paper the honor of making an extract of some of its contents, you selected only that part of an article which was not original, unfortunately overlooking my acknowledgment of the *Popular Science Monthly* as the source of the paragraph which you published.

Very respectfully yours,
P. H. VANDER WEYDE, M.D.
Editor *Manufacturer and Builder*.

[Doubtless all apology that he claims is due from us to Dr. V. Unfortunately the number of his journal he refers to has been mislaid, and we therefore take his word for it.—ED.]

Gas-Lighting.

Little girls light the gas for Des Moines, Iowa.

The Fishkill Gas-Light Company has reduced its capital stock from $100,000 to $90,000.

Delhi Gas Works.—The Delhi (Delaware Co., N. Y.) *Gazette* says that place is to be lighted with gas. Mr. Edgar Hudler of Rondout has secured sufficient consumers to justify the outlay, and obtained a grant from the corporation to lay pipes in the streets.

[The New York *World* says that in view of this "Delhi is Delhited."

Mr. John Cartwright, the able and energetic superintendent of the Poughkeepsie Gas-Light Works, has accepted the position of superintendent of the Matteawan Gas Works. He will attend to the business of both, and there is no doubt but that he will give satisfaction.

Obituary—George Rugan.

It has become our painful duty to announce to the members of the gas fraternity, the demise of one of its most painstaking members, Mr. George Rugan, who departed this life on the 30th day of January. In the death of Mr. Rugan the profession will lose the services of an energetic, accomplished, and honorable engineer, who by his own zeal and knowledge had arrived at so prominent a position as that which he held at the time of his decease.

Mr. Rugan was born at Philadelphia in the year 1821, and was in his 52nd year. He received a good English education at a Friends school in that city, and afterwards finished at a Lutheran College in Rhinebeck, N. Y. In 1858 he was elected Register of the West Philadelphia Gas Works, and from thenceforth he made the art of gas engineering a special study. He received an offer of the situation of superintendent of the Memphis Gas Works in 1860, and remained there about one year. Owing to ill health and the mutterings of the approaching conflict between the North and South, he gave up his situation and returned to Philadelphia.

Shortly after this he entered the employ of the American Meter Company. He did not remain long with them, having been appointed superintendent of the Terre Haute Gas-Light Company, to which place he removed in 1864, and has ever since been connected with that company as secretary and superintendent.

Mr. Rugan was indefatigable in his attention to the interests of the company, and it is thought by his friends that the anxiety and overwork which fell to his share during the erection of the new works, were the superinducing causes of the malady which carried him off—congestion of the brain.

He was of a hopeful and happy disposition, always looking at the bright side of every object, and attracting many warm friends by his social qualities—temperate in all things, unimpeachably honest, charitable to the faults of others, but always ready to break a lance in the interest of a cause which he espoused.

Many of our readers will remember that Mr. Rugan was a contributor to the columns of this Journal, and a very valued one. His articles were always of a practical nature, simple facts, stated in the language of a man who was thoroughly conversant with the subject on which he commented. We sympathize with the members of the profession, and the relatives and friends of the deceased, for the loss of him who was, bnt is no more.

Gas Cannel and Coals.

Analysis of the comparative value of has made from coals and cannel, by Dr. Andrew Fife, Professor of chemistry, King's College, Aberdeen:

"A ton of English caking coal yields, on an average, at gas-works, 8,000 feet of gas; and though a larger quantity was with my apparatus, yet we must take 8,000 as the quantity on a large scale. The value of the coal is taken as 1.

"The Wigan cannel yielded 9,500 and 11,500; the value of the gas, bulk for bulk, being the same, viz., 1·85 to the former as 1. Now, taking into account the quantity of gas afforded, the value of the coals for yielding light, by the consumption of their gases, is as 2·23 for the one quantity, and ·25 for the other. Taking the average, we state the value of English cannel coal as 2·35, or say 1⅓ to Newcastle coal as 1."

We also give the following analysis of the cannel raised by the Ince Hall coal and cannel company, by John Leigh, M.R.C.I., consulting chemist to the Manchester Corporation gas works:

Carbonic Oxide and Aqueous Vapor	1·53
Olefiant Gas and divers Hydrocarbons	8·50
Atmospheric Air	4·32
Nitrogen	0·19
Hydrogen	40·30
Light Carburetted Hydrogen	33·83
Carbonic Acid	11·35
	100·02

Quantity of gas produced.....11·673 cubic feet
Specific gravity of gas..... 5·20 " "
Coke produced from 1 ton of cannel.....13 cwt. 0 qrs. 13 lbs.

This cannel is used by the chief gas-works of this country, including London, Liverpool, Manchester, and Birmingham; and by the principal foreign gas-works, both on the Continent and in North and South America.

Analysis of Wigan gas coal, made by J. E. Clift, engineer of the Pagoda gas-works, Birmingham:

Carbon, from 100 parts		84·5
Hydrogen	"	5·14
Oxygen	"	2·10
Nitrogen	"	2·20
Sulphur	"	·33
Ash	"	4·12
		98·39
Loss		1·61
		100·00

Products obtained from one ton of gas coal, being the average results obtained from using 300 tons in making gas:

Gas produced, 10,200 cubic feet; illuminating power—one Argand burner, consuming five feet per hour thirteen spermaceti candles, of six to the pound; specific gravity, 462; atmospheric air being 1·00. Coke produced, 13 cwt., 3 qrs., or 44 imperial bushels; suitable for iron-founders, brass-founders, and malsters. Ammoniacal liquor produced, 20 gallons; 1 gallon requiring 10 ozs. of the sulphuric acid of commerce to saturate it. Tar produced, 10 gallons.

Purification of the gas.—1,000 cu. ft. of gas requires 12½ lbs. of lime for its purification; which shows it to be comparatively very free from sulphur.

The other impurities of coal gas are not more abundant than is that made from other coals.

Further analysis of same gas coal, made by Prof. Thompson, of London:

Specific gravity	1·270
Coke, per cent	65·2
Volatile matter per cent	34·8
Cu. ft. of gas per ton, gross	11,400
" " " purified	11,200
Impurity per cent., in gas	1·8
Specific gravity of purified gas	406·
Illuminating matter condensible by Bromine, per cent	4·25
Carbonic oxide in purified gas p.c.	4·

Illuminating power of the gas, burnt at 5 feet per hour, equal to 13·8 spermaceti candles, each consuming 120 grains per hour.

Heating power of the coal.—One lb. will convert 15½ lbs. of boiling water into steam.—*Higginson's Coal Circular.*

Threatened Strike of the Gas Men.—The Gas Men's Protective Union met last evening. Arrangements were made for a strike should the companies not accede to the demands of the men. Committees were appointed to wait on the superintendent of each gas company. Under no consideration will they work beyond eight hours. The time for the strike has not yet been fixed. It is the intention of the gas men to strike on an evening and leave the city in darkness. The officers of the gas companies are to be warned of the strike. The gas companies, it is said, intend to employ Italians in case of a general strike. —*N. Y. Sun.*

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

WEDNESDAY, APRIL 2, 1873.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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OBITUARY.

John Torrey, M. D. : L. L. D., member of numerous learned societies throughout the world ; died on the tenth of March, of pneumonia. He was born in 1798, and had therefore passed the age at which men usually give up an active life. His vigor and energy were such, however, that but for an acute disease, he might have been spared to us yet for many years to come.

The present writer was a pupil of Dr. Torrey. He feels therefore a right to regard this loss as a personal one. In adopting the following remarks from the *Engineering and Mining Journal*, doubtless from the pen of Mining Commissioner Raymond, an intimate personal friend of the departed ; the writer feels that he could himself say no less, and probably but little more ; and certainly *not* say it better, or more to the purpose :

"Professor Torrey's death will make audible but it cannot make more favorable, the judgment of him which all who knew him entertained, and those most profoundly who knew him best. No doubt such early and constant friends as Gray and Henry will speak worthily of his virtues and his fame. But we venture nevertheless our humbler tribute, in recognition of his public and scientific career, and in expression of our personal esteem and love

John Torrey was born in New York City. In 1824 he was appointed Professor of Chemistry, Geology and Mineralogy in the Military Academy of West Point. In 1827 the College of Physicians and Surgeons in this city induced him to accept their Professorship of Chemistry and Botany, which chair he occupied with great success until 1855. In 1830 he also became Professor of Chemistry and Natural History in the College of New Jersey at Princeton, and only relinquished it in 1853 when he was appointed by the Government Chief Assayer in the United States Assay Office at New York. To the duties of this position he added those of Professor and Trustee in Columbia College. His first work was a catalogue of the plants to be found in a radius of thirty miles around New York, published in 1819. The following is a list of his later works :

Flora of the Northern and Middle States, 1824. Compendium of the foregoing work, 1826. *Cyperaceae of North America*, 1836. *Flora of the State of New York*, 2 *vols*, 1843-44. *Botanical Reports of the Various Land Exploring Expeditions of the United States from* 1822 *to* 1858. *Appendix to Dr. John Lindley's Introduction to Botany*, 1831. He also edited, with Dr. Asa Gray, the *Flora of North America*. In 1869 Prof. Torrey presented to Columbia College, of which institution he had long been a trustee, his extensive and valuable herbarium and his entire botanical library. Although of advanced age, Prof. Torrey was up to within a few weeks of his death, quite active, and, in addition to his many duties as a scientific man, added those of Treasurer to the New York Society of the Cincinnati.

Such is a brief summary of his long and busy, though quiet life. The published works we have enumerated are so many monuments of his fame, recognized throughout the scientific world. His name and that of his colleague, Dr. Gray, rise into view, like the twin peaks of the Rocky Mountains, that bear witness to the eminence of these most illustrious of American botanists. But as one who views from afar the distant heights of Torrey's Peak against the sky, gains no conception from that view, of the flowers, running streams, cool shadowy glades and sweet surprises of beauty that cluster below the sublime summit, so the celebrity of the *scientist* is an incomplete and barren aspect, without the nearer knowledge of the honor, gentleness, enthusiasm, and unaffected piety, that blossomed and were musical in the man.

His books retain for us the fruits of his study and research. The pure and noble example of his life is an additional volume—and the best of all."

The only addition we would make to this is that the memory of Dr. Torrey has special claims upon the Gas Fraternity, from the fact that he has been for about twenty years the chemical adviser of our leading Gas-Light Company, the Manhattan. His influence, though exerted in a manner so little obtrusive, that it has doubtless been little recognized outside of a narrow circle; has been great, upon the progress of the gas manufacture in America.

THE OXYHYDROGEN LIGHT IN AMERICA.

The verdict on the Tessie du Motay methods in Paris seems to have been condemnatory ; but this, as has been said before, does not weigh in these columns.

The Editor of this Journal has repeatedly expressed his wish to acquire something further than a mere newspaper familiarity with this subject ; but influences which he has not cared to inquire into, seemed for a time to interfere. For the last three or four months, however, there has been a real obstacle, whose influence with the writer of this, was peremptory. This was information received that the investigation had been placed in the hands of a man whose decision would have had conclusive weight, a man who has just departed from among us, Dr. John Torrey.

In the meantime, so great a number of inquiries has come, oral and written, regarding this subject, that the Editor has determined he will no longer remain in the dark ; and that he will enter personally into the investigation, and put himself into position to serve his friends and correspondents with some report, (reliable so far as his reliability extends) upon the real facts and results that have been attained to in this country ; here, and in Buffalo, Troy and such other places as have witnessed the working of these methods on a manufacturing scale.

It is expected, and it is in fact reasonable to expect, that the AMERICAN GAS-LIGHT JOURNAL should be in position to give this information ; and it is certainly very curious that experiments of such magnitude and importance should have been in progress among us so long, apparently without any means of our getting, except at inordinate expense, any information of a reliable nature regarding them.

The Editor is pleased to be able to state, that the parties interested in the introduction of the Tessie du Motay methods offer every possible assistance and facility (as indeed it is their interest to do), and that he anticipates no obstacle in the way of such an investigation as may set some or all of these questions at rest.

GAS-CONSUMPTION OF AMERICAN CITIES.

In the last issue there crept, without the knowledge of the Editor (who was absent) an item which must have been of an antiquity of at least a decade ; and which must have been laughed to scorn by all who are well-informed on the subject. The consumption of New York city was given as twelve hundred millions feet per year. whereas the Manhattan Gas-Light Company alone must now serve out more than fourteen hundred millions a year.

It is probable, speaking without the actual statistics, which there has been no opportunity to collect ; that the present annual make of gas, by the five companies that supply the population of New York Island, will come up to four thousand millions per annum.

WOOD'S GUIDE TO GASLIGHTING.

In the issue of Jan. 16th of this year, the fact was announced that a new edition of this valuable little work was issued. Inquiries have since been made at the office of this Journal for copies, which could not be supplied. It will be of interest therefore to some, to know that Mr. T. C. Hopper, Superintendent of the American

Meter Company, corner of Arch and Twenty Second streets, Philadelphia, has, or expects soon to have, a supply of copies, which he will transmit to those who will correspond with him.

☞ Attention is called to the new advertisement on this page of Nicholson & Weld of 111 Broadway, who intend placing in our hands samples, the results of the analyses of which will be duly put before our readers.

[EDITORIAL NOTE.—Professional engagements of the editor have interfered during two months past with the editorial duties of this Journal. The investigations that have occupied him, to an absorbing degree, have related to subjects coming within the scope of the Journal, and which, when fully matured and completed, will be laid before its readers. This must serve as some apology to the constituents of the Journal for the laxity which for several issues has doubtless been apparent to critical readers.]

A NEW INVENTION FOR LIGHTING STREETS.

FROM REPORT OF
THE FRANKLIN INSTITUTE.

PHILADELPHIA, Jan. 20, 1873.

The Committee on Science and the Arts, to whom was referred for examination

Dyott's Patent Street Lamp.

Report having given it a careful examination, that they deem it superior to other Street Lamps in the following particulars:

It has a *double* semitransparent top with an intervening air space, which keeps the top cool, and prevents that breakage of glass so prevalent in other Street Lamps, and by the arrangement of its drafts more complete combustion is produced, and a greater amount of light is obtained from a given quantity of gas. Its semitransparent Reflector transmits sufficient light to illuminate the upper portion of surrounding buildings, and reflects the light where it is wanted, around and below. It also shelters the heated glass globe from rain, hail, and snow, and prevents breakage. It is peculiarly well adapted to display Street Names. Its arrangement and facilities for cleaning are excellent. It possesses decided advantages over other Street Lamps, and its tasteful design, in connection with ts moderate cost and the durability of its construction, commend it as an article for general street and other uses.

By order of the Committee.

D. S. HOLMAN, Actuary.

THE EXPOSITION AND INDUSTRIAL FAIR OF KINGS COUNTY, N, Y.

FIRST DIPLOMA Awarded to M. B. DYOTT for Street Lamps of superior excellence, at the annual exhibition at the City of Brooklyn, N. Y., 1872.

ATLANTIC CITY, August 20, 1872.

We the undersigned, Mayor and Members of Council of Atlantic City, N. J., having had twenty of Dyott's Patent Street Lanterns in use for some months, take pleasure in saying they have given entire satisfaction. Having no doors they are not subject to exposure, are durable, beautiful and easily cleaned —are the best we have seen or used, and have no doubt they will be generally adopted, when their advantages become known to Gas Companies and City Governments.

(Signed by the Mayor and every Member of the City Council.)

We the undersigned citizens of Atlantic City, having Dyott's Patent Street Lamp at our Hotels, fully concur in the recommendation of the same by our Mayor and City Council hereto annexed.

WILLIAM G. BARTLETT,
ALBERT BROTHERS,
BARCLAY S. SMITH,
CHARLES PALMER.

For further particulars address or call on

M. B. DYOTT,
114 South Second Street,
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The annexed letters from the Presidents of our leading Companies, where it has been in use the longest:

OFFICE OF THE MANHATTAN GAS CO.,
IRVING PLACE, N. Y., Jan. 28, 1873.

J. W. BARTLETT, ESQ.,
569 Broadway, New York.

Dear Sir, In answer to your inquiries as to our experience in the use of your Patent Improved Torch and Key for lighting the public lamps, I beg to say that we have used them during the past three years, and find them satisfactory in every respect. We have by their use been able to dispense with one third of the number of men to light the lamps, besides saving the expense of ladders, matches, etc.

They do not interfere in the least with the proper care of the lamps, and we find the lamps to burn quite as well without the bottom glasses as with them. Sincerely yours,

CHARLES ROOME, President.

OFFICE OF THE NEW YORK GAS-LIGHT CO.,
155 and 157 HESTER ST., NEW YORK, Dec. 17, 1872.

J. W. BARTLETT, ESQ.

Dear Sir: In relation to your Patent Improved Torch and Key for lighting and extinguishing street lamps, I would say that we have had them in use since February 1870, and find them all that has been represented. They save a great deal of time and labor in lighting, and have given satisfaction to the company and to the men who light the lamps.

Respectfully yours,
THOS. K. LEES, Vice President.

P.S.—Our foreman informs me that the cost of making and fitting your Improved Key to the shanks of the ordinary gas cocks does not exceed five (5) cents eacn. T. K. LEES,
Vice President.

SPRINGFIELD MASS., Jan. 14, 1873.

MR. BARTLETT.

Dear Sir: I am greatly pleased with the Torch and Key for lighting our lamps. When I am out in the storm, I often think what an improvement it is over the old way. The difference in speed or rapidity in doing the work, seem to me as great as that between oxen and the locomotive.

T. W. HAMILTON,
Contractor for Lighting the Public Lamps.

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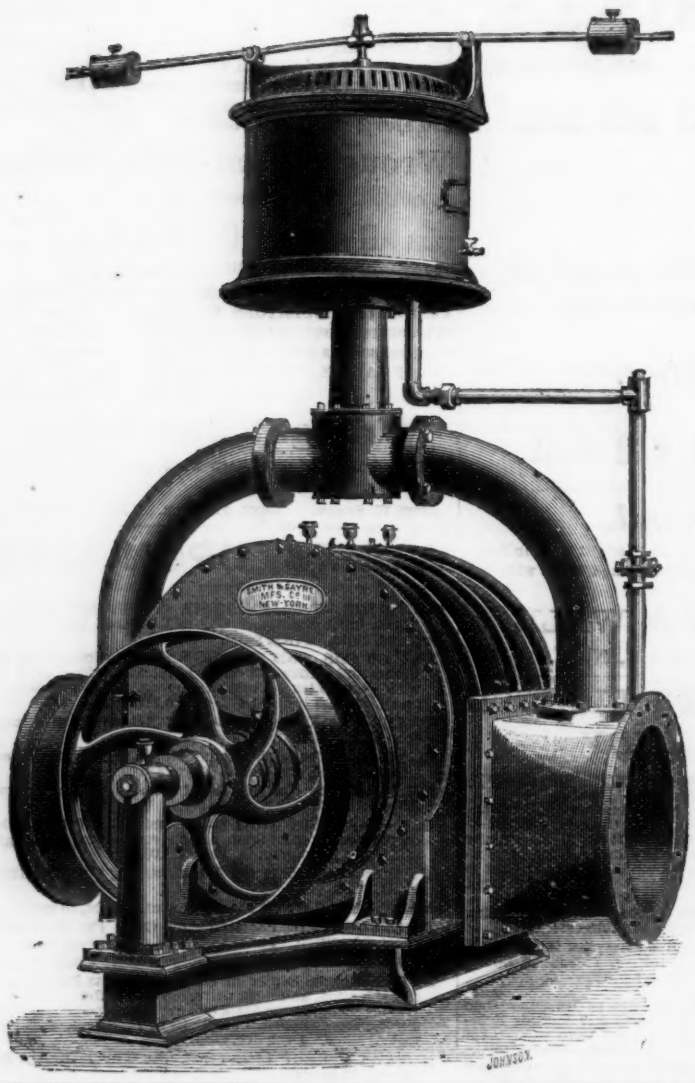
And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary Fan. The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola, and 33 per cent fuel. Address

JAMES M. SAYRE, Treasurer. G. G. PORTER, President.

CHARLES W. ISBELL, Secretary. OFFICE, 26 LIBERTY STREET, New York.

AMERICAN

GAS SCREEN MAN'F'G COMPANY.

TO GAS-LIGHT COMPANIES.

Your attention is respectfully called to the GAS SCREEN now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other screens now in use.

The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces, the edges of the frame being grooved to prevent abrasion.

The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the Screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4te Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFFE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of open space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yours,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3. 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU.

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give yau my experience.

Yours truly,
P. E. DEMILL. Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co., Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass., Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas-Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.: Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **A. P. JAQUES, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass

AGENCY FOR

GIBSON'S IMPROVEMENT

IN THE

Manufacture of Coal Gas,

41 PINE STREET, ROOM 1.

The undersigned having been appointed Special Agent for the introduction of GIBSON'S Substitute for Dip-Pipes in the Manufacture of Coal Gas, respectfully presents for the consideration of Gas-Light Companies the Circulars and Pamphlet issued by the American Coal Gas-Light Imp. Co., descriptive of the value of GIBSON'S Improvement, and the mode by which Gas-Light Companies can satisfy themselves of its usefulness, without trouble or expense, at their own works.

Orders for fitting up Valves of any desired form or patent, *subject to the generality of the Gibson claim*, and also for SUPPLIES and MATERIALS of every description required for the use of Gas Light Companies promptly attended to by

W. H. GRENELLE, Special Agent.

REFERENCE.—RICHARD . MERRIFIELD, ESQ., late Vice President MANHATTAN GAS-LIGHT COMPANY.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS and other buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity, Retort Settings, Condensers, Washers, Exhausters, Purifiers, Holders, Coal Hoisting Apparatus, Iron Roofs, and every description of Machinery required in the Manufacturing of Gas.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Blowers for Forgers,
Pumps for Water, &c., &c.

REFERENCES:

CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
SAMUEL DOWN, President American Meter Company, N. Y.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
CHARLES MOWTON, Engineer New York Gas-Light Company, N. Y.
SAMUEL P. PARHAM, Engineer Mutual Gas-Light Company, N. Y.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL.
HENRY J. DAVISON, Engineer, 77 Liberty Street, N. Y.
HERRING & FLOYD, Oregon Iron Foundry, 738 Greenwich Street, N. Y.
FREDERICK SABBATON, Engineer Troy Gas-Light Company, Troy, N. Y.
Col. WHITE, Engineer People's Gas-Light Company, Williamsburgh, N. Y.
GEORGE W. PARSONS, Sup't and Eng'r, Rochester Gas-Light Co., Rochester, N. Y.
GEORGE W. EDGE, Engineer, Jersey City Gas-Light Co., Jersey City, N. J.
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Professor SILLIMAN, New Haven, Conn.
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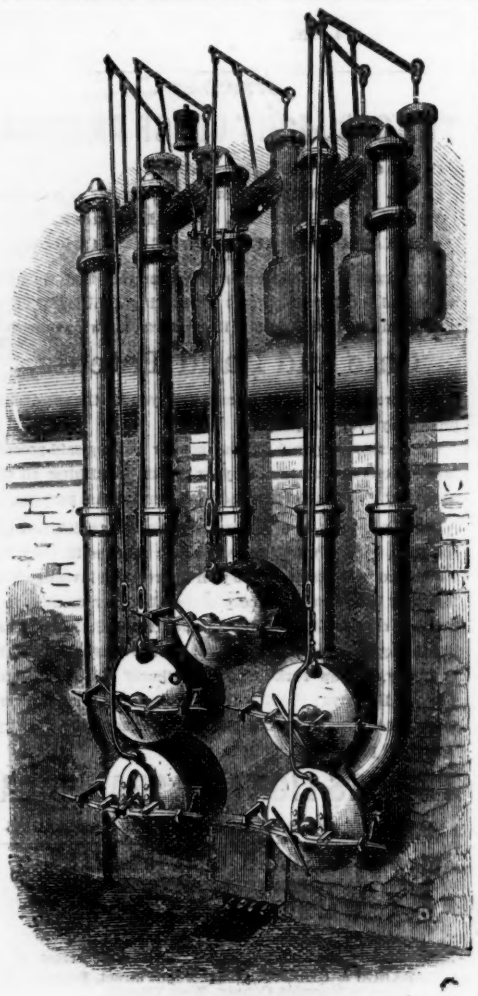
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [254-



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ADJUSTABLE AUTOMATIC DIP-SEAL,
AND
Improved Retort Lids.

The Seal closes automatically, when the retort-lid is removed, and is broken by replacing the lid. No mistake can possibly be made. The rods are adjustable in a moment to any contingency. The new attachments are adaptable to any Works. Cost only that of rough castings. No lute used, and no leakage at lids. Half the number of lids only needed. Capacity of mains greatly increased. In new Works no mains. No carbon in retorts, seldom in stand-pipes. Addre

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OHIO GAS CANNEL,
From the Sterling Colliery.

I am now prepared to place in the market, through my agencies as below, a regular and unlimited supply of this valuable Cannel, for gas purposes. A recent analysis, by Prof. WURTZ, Editor of this Journal, at the Laboratories of the NEW YORK GAS-LIGHT COMPANY, gave 47½ per cent of Volatile Matter and 45 bushels to the ton of a fair quality of coke. The yield of gas was at the rate of 9,500 feet per ton of about 27 candle power. It is not highly sulphurous, can be purified by Lime, and the ash from the coke does not clinker.

GEORGE R. TUTTLE, Proprietor,
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GENERAL AGENCIES.
George Merryweather, 5½ Pine Street, N. Y.
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ATLANTIC DOCK
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FERRIS, WOLCOTT AND DYKEMAN STREETS,
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Office 98 Liberty Street. P. O. Box 2,348

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ENGINEERS AND CONTRACTORS
For the Erection or Extension of Gas Works.
PLANS, SPECIFICATIONS AND ESTIMATES.

MANUFACTURERS of every kind of Gas Machinery, Retorts Bench Castings, Wrought Iron Work, Multitubular and Air Condensers, Washers, Scrubbers, Purifiers, Exhausters with every equipment complete for large or small Works, Gasholders, Telescopic or Single; Iron Roof Frames with Cornice Gutters, covered with Corrugated Iron or Slate; Iron Doors and Iron Pivot Blind Windows; Coke Barrows, Fire Tools, Retort Lids, Cotter Bars and Screws, Stop Valves, Tar Valves for Regulating Dip in Hydraulic Mains, Pressure Governors for Street Mains, and Compensators for Exhausters that are unrivalled for unvarying accuracy Steam Engines, Boilers, Etc., Etc.

Agents for G. W. EDGE'S PROCESS for removing Carbon from Retorts.

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CAUTION.

SEVERAL CONTRIVANCES HAVING BEEN DEVISED for the purpose of dispensing with the dip-pipe seal, by means of a valve, or cut-off, between the retort and the hydraulic main, in gas works, since this method of making gas was introduced by the AMERICAN COAL GAS LIGHT IMPROVEMENT COMPANY, all of which are infringements upon Letters Patent, numbered 95,459—116,450—and 119,135, owned by said Company. All Gas-Light Companies are cautioned against the use, without license or authority from the undersigned., of said devices.

The Am. Coal Gas Light Improvement Co.
JOHN H. BLAKE, President.
5 PEMBERTON SQUARE, BOSTON. 41 PINE STREET, N. Y

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Having immediate rail and water communication with New York and Philadelphia, as well as the coal and iron regions we have every advantage of situation.

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Used in the Erection of Gas and Coal Oil Works.

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PARTIES WRITING TO THE UNDERSIGNED ON GAS Matters, will please address J. B. CHICHESTER,
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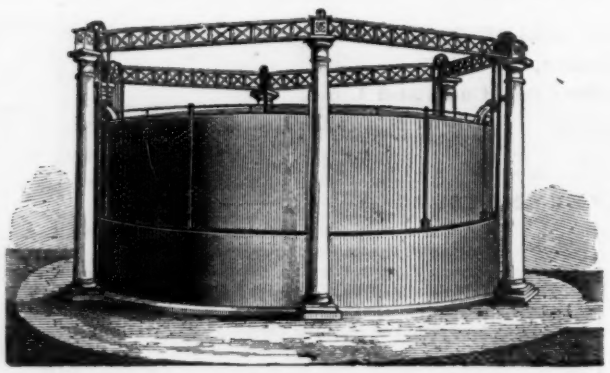

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Estimates furnished of the cost of Works, and cost to Manufacture Gas in any Locality.

Gasholders,

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Particular attention given to Enlarging and Re-building Gas Works.

For Lighting Manufactories, our Rosin Gas Works have been successfully used for *many years* past. They require but a small outlay, and afford a *safe* and *economical* light.

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1842. *1873.*

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1½ to 48 inches diameter.

Cast Iron Flange Heating and Steam Pipe.

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Fire Hydrants,

GAS HOLDERS,

TELESCOPIC OR SINGLE.

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MADE FROM BEST MALLEABLE IRON AND STEEL.

FURNISHED WITH LONG OR D HANDLES.

Perfect in their operation, a very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

Orders addressed only to

O. R. BUTLER,
Sole Agent.
No. 96 Maiden Lane, N. Y.

CAUTION.

Gas Companies, and all parties using Screening Shovels are cautioned against the purchasing (or manufacturing) of any other than myself, or my agents, COKE SCREENING SHOVELS, made either in whole, or in part, of **Malleable Iron,** as such is decided to be an infringement of Butler's Patent of June 4, 1872.

O. R. BUTLER,
96 Maiden Lane, N. Y.

OFFICE OF

THE GAS-LIGHT CO. OF AMERICA,

C. K. GARRISON, President.
E. W. McGINNIS, Secretary and Treasurer.
JOHN P. KENNEDY, Chief Engineer.
LEONARD D. GALE, Consulting Chemist.

GENTLEMEN: We beg leave to inform you, that we have purchased the Patent process for making ILLUMINATING GAS from PETROLEUM and its products, known as the

Gale and Rand Patents,

and we are now prepared to treat with you for the use of said process by your Company.

We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

We do not deem it necessary to enter upon a detailed description, here, of the processes above referred to, deeming it sufficient to state, to secure your interest and investigation, that they have been in successful operation, for months, in a number of Gas-Light Works in the United States, and are now being introduced in the works of the Mutual Gas-Light Company, of New York City; the Citizens' Gas-Light Company, of Brooklyn; the New Orleans, San Francisco, and very many other Gas-Light Companies throughout the country.

For full particulars, address

THE GAS-LIGHT CO. OF AMERICA.

248-tf] P. O. Box 5220, New York City.

THE DESPARD COAL COMPANY

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DESPARD COAL

To Gas Light Companies throughout the country.
Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, } Baltimore.
Company's Office, 29 South street, }

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

. Reference to them is requested 204-1y

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Mr. Whitney has had a practical experience of more than twelve years spent in pursuits directly connected with industrial operations and Patent Agency business, which will enable him to care for the interests of his patrons in the most satisfactory manner. 294

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

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Sydney,
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Caledonia,

GAS COAL,

AGENT FOR

The Westmoreland Coal Company.

Orders received for the delivery of

Red Bank Cannel

from the Red Bank Colliery, Penn., for shipment after 1st May.

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AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3-inch and upwards, cast in 12-ft. lengths.

☞SEND FOR CIRCULAR AND PRICE LIST.☜

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MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little Ash, and scarcely any clinker. 304-1y

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Consulting Engineer.

Steel and Iron Forgings, Light and Heavy Steel Castings to any pattern. Would call attention to his new article for Blacksmith's Forges, Jones's Patent Tuyere Iron, which is in successful operation in the leading establishments; can be used in any Forge now at work, or in combination with Jones's improved Cast Iron Forge, plain or galvanized. Is prepared to furnish estimates of all kinds of Iron work used in the construction and carrying on of Gas Works, including supplies. Sole agents for A. L. Havens's Adjustable Automatic Dip Seal and Improved Retort Lids. Will give personal attention to the prompt execution of all orders. Address 60 Vesey Street, New York. 301

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EDITOR—PROF. W. H. WAHL, PH.D.

ASSISTED BY THE COMMITTEE ON PUBLICATIONS.

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The Journal is now in its forty-fifth year of publication, and has become a standard work of reference.

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Continental Works,

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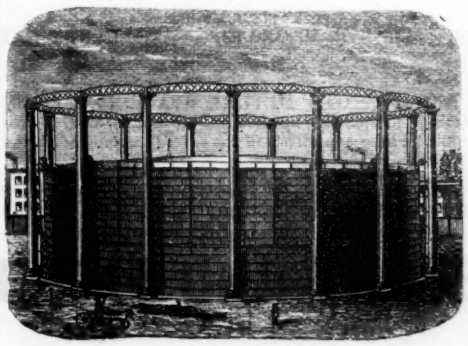

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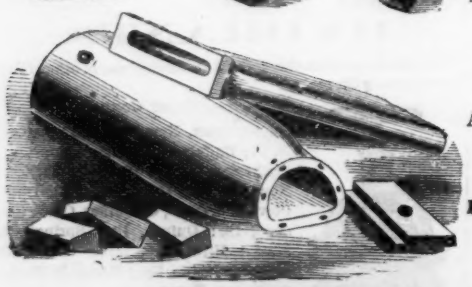

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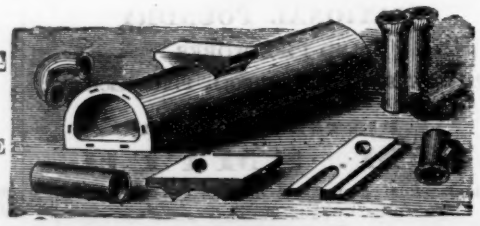

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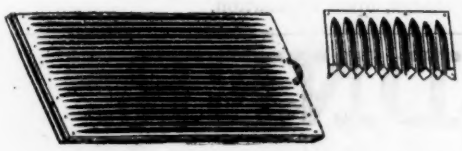

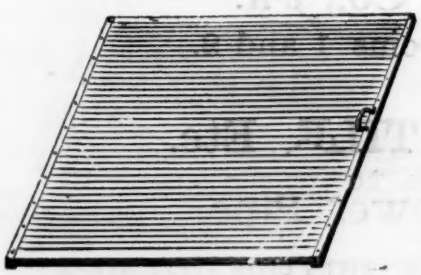

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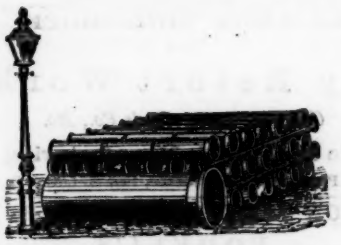

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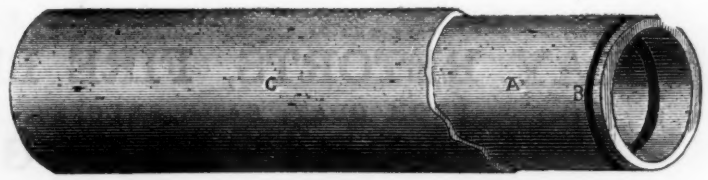

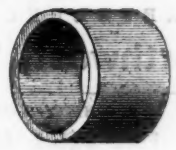

FIG. 2.

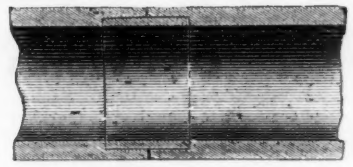

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

Above is a cut of the

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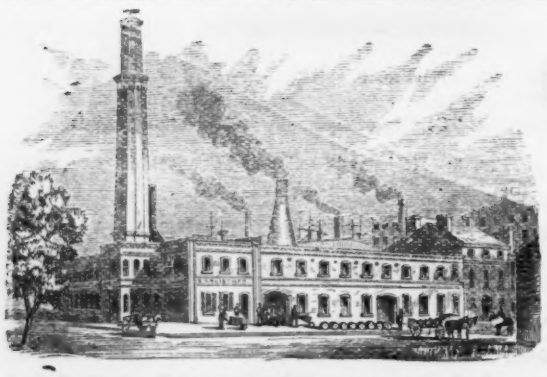

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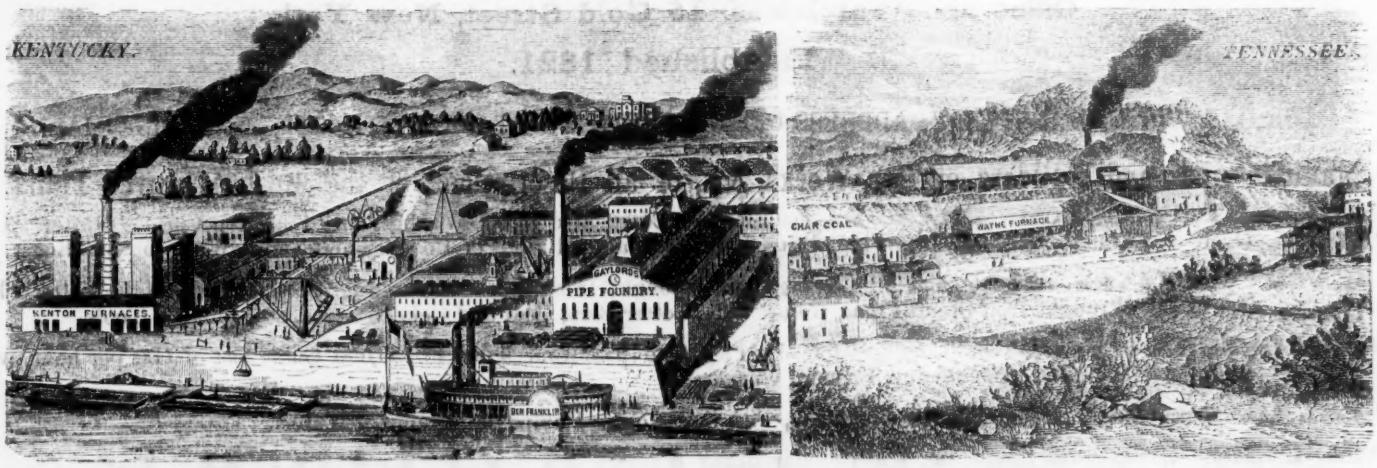

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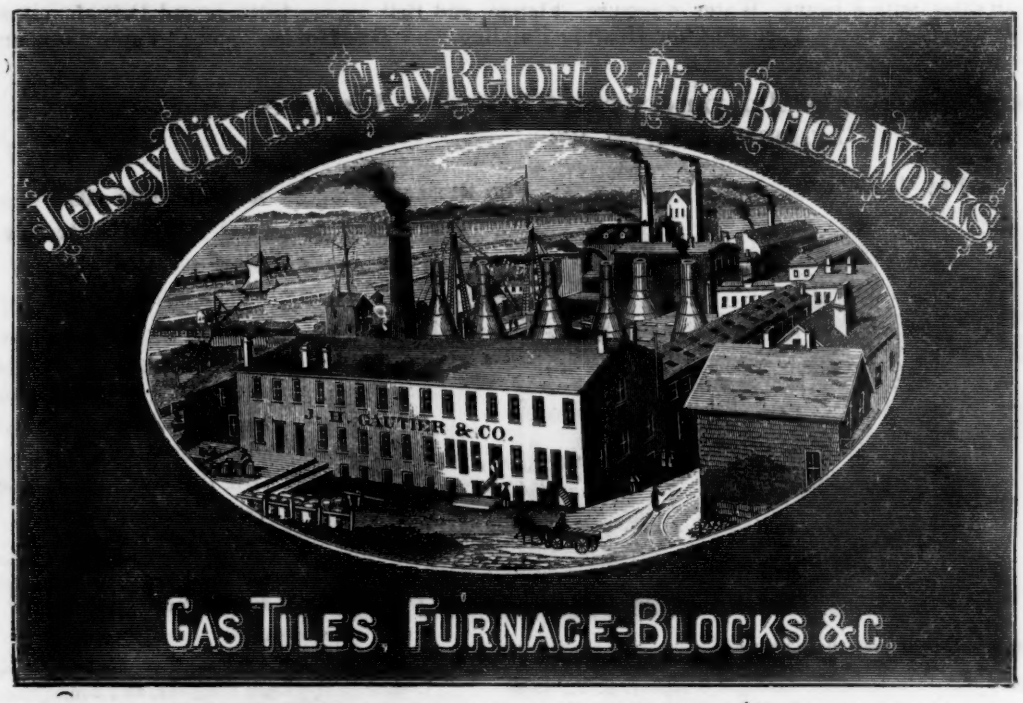

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Manufacturers and Builders of Gas Works, &c., of all Descriptions, of the Most Approved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons, and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 Cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Guages.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Improved Centre Valve.

PATENTED JUNE 6TH, 1871.

Fig. 1 represents a Dry Centre Valve complete for four Purifiers. It is also arranged so as it can be used for one, two, or three Purifiers.

Fig. 2 represents a section through.

The construction of the Valve is such that one Purifier is always shut off for cleaning or repairing.

The claim in this improvement is the concentric inlet

Fig. 1.

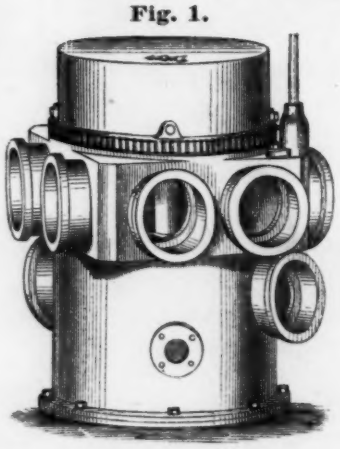
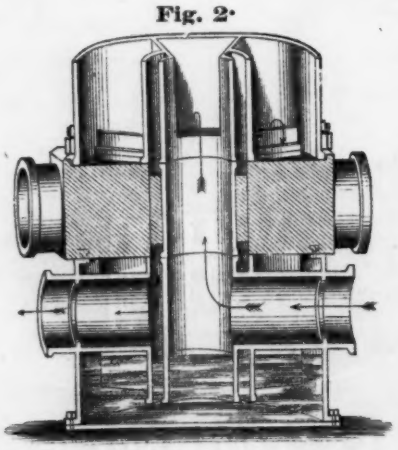


Fig. 2.



and outlet, drip pipes, rotary valve, and the covered radial joints.

The joints being covered prevent the tar and ammoniacal liquor, dropped by the gas, from rusting the joints, which happens in all other Valves where the joints are not covered, thereby making a leaky Valve.

This Valve has been in use for three years, with perfect satisfaction.

We refer to the following Gas Companies, who have them in use:

Lowell Gas-Light Company, Mass., 20 inches.
Hartford City Gas-Light Company, Conn., 16 in.
Nashville Gas-Light Company, Tenn., 16 in.
Utica Gas-Light Comwany, N. Y., 12 in.
Lynn Gas-Light Company, Mass., 12 in.
Lewiston Gas-Light Company, Maine, 12 in.
Albany Gas-Light Company, N. Y., 12 in.
Salem Gas-Light Company, Mass., 12 in.
Columbus Gas-Light Company, Ohio, 12 in.
Trenton Gas-Light Company, N. J., 12 in.
New Britain Gas-Light Company, Conn. 10 in.
Westchester Gas-Light Company, N. Y., 10 in.
St. Paul Gas-Light Company, Minn., 10 in.
Schenectady Gas-Light Company, N. Y., 10 in.
Rahway Gas-Light Company, N. J., 8 in.
Atlanta Gas-Light Company, Georgia, 8 in.
Altoona Gas-Light Company, Pa., 8 in.
Harrisburg Gas-Light Company. Pa., 8 in. and 6 in.
East Newark Gas-Light Company, N. J., 6 in.
Cumberland Gas-Light Company, Mo,, 8 in.
Augusta Gas-Light Company, Ga., 6 in.
Princeton Gas-Light Company, N. J., 6 in.
Lockhaven Gas-Light Company, Pa., 6 in.
Hagerstown Gas-Light Company, Md., 6 in.
Coatesville Gas-Light Company, Pa., 6 in.
Uniontown Gas-Light Company, Pa., 6 in.
Wooster Gas-Light Company, Ohio, 6 in.
Pontiac Gas-Light Company, Mich., 6 in.
Battle Creek Gas-Light Company, Mich., 6 in.
Lawrence Gas-Light Company, Kansas, 6 in.
Indiana Gas-Light Company, Pa., 8 in.
Washington Gas-Light Company, Pa., 6 in.
Medina Gas-Light Company, N. Y., 6 in.
And many other Gas Companies.